# Jean Team

# KING SAUD UNIVERSITY COLLEGE OF COMPUTER & INFORMATION SCIENCES DEPT OF COMPUTER SCIENCE

CSC311 Design and Analysis of Algorithms

Second Semester 1444

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#### **Tutorial #2**

# By. 3meer

1. Consider the pseudo-code below:

ALGORITHM 
$$MaxElement(A[0..n-1])$$

//Determines the value of the largest element in a given array
//Input: An array  $A[0..n-1]$  of real numbers
//Output: The value of the largest element in  $A$   $maxval \leftarrow A[0]$ 
for  $i \leftarrow 1$  to  $n-1$  do

if  $A[i] > maxval$ 
 $maxval \leftarrow A[i]$ 

return  $maxval$ 

( $u \in \mathcal{M} - 1$ 

- a. What is the basic operation of this algorithm?
- b. Give the best-case and worst-case time complexities of this algorithm in asymptotic notation.

b) worst case
$$2n-1 \leq 2n+n$$

$$\leq 2n$$

$$\leq 2n$$

$$\leq 2n$$

$$\leq 2n$$

$$\leq 2n$$

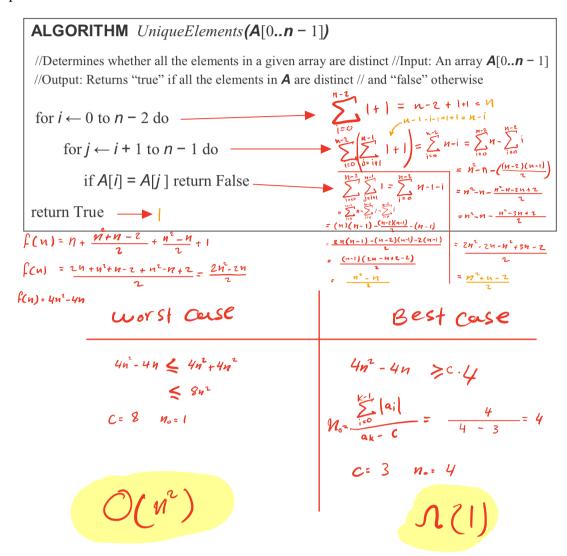
$$\leq 2n$$

$$\leq 2n-1 > n$$

$$\leq 2n$$

$$\leq$$

**2.** Consider the algorithm below and give its best-case and worst-case time complexities in asymptotic notation.



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#### 3. Consider the algorithm below:

#### ALGORITHM F(n)

//Computes **n**! recursively //Input: A nonnegative integer **n** //Output: The value of **n**!

if n = 0 return 1

else return F(n-1) \* n

- a. What is the algorithm's basic operation?
- b. What is the resulting recursive equation?
- c. Solve the equation you gave in (b).
- d. What is the worst case time complexity of this algorithm?

### a) Multiplication

b) 
$$T(n) = T(n-1)+1$$
  
 $C) = T(n) = [T(n-2)+1]+1$   
Stop =  $T(n-2)+7$   
 $n-k=1$   
 $k=n-1$  | after k  
Substitution  
 $T(n-k)+k$   
 $= T(n-(n-1))+(n-1)$   
 $= 1+n-1$   
 $T(n) = n$ 

$$\begin{array}{c}
d) \\
n \leq c g(n) \\
\leq n \\
c = 1 \\
n_0 = 1
\end{array}$$

4. Consider the algorithm below:

### ALGORITHM Q(n)

//Input: A positive integer *n* 

if n = 1 return 1

else return Q(n-1) + 2 \* n

- a. What is the algorithm's basic operation?
- b. What is the resulting recursive equation?
- c. Solve the equation you gave in (b).
- d. What is the worst case time complexity of this algorithm?

## a) Multiplication

C)=
$$T(n) = [T(n-2)+1]+1$$

Stop

=  $T(n-2)+2$ 

after k

Substitution

 $T(n-k)+k$ 

=  $T(n-(n-1))+(n-1)$ 

=  $1+n-1$ 

T(n)=  $n$ 

d)

 $M \leq C g(n)$ 
 $\leq M$ 
 $C=1$ 
 $No=1$